CLAIMS

1. Hydroxyapatite (HA) incorporating an alpha-emitting radionuclide or an *in vivo* generator for an alpha-emitting radionuclide.

2. Hydroxyapatite according to claim 1 comprising an alpha-emitting radionuclide chosen from the group ^{211}At, ^{212}Bi, ^{223}Ra, ^{224}Ra, ^{225}Ac, ^{227}Th.

3. Hydroxyapatite according to claim 1 comprising a beta-emitting radionuclide, that decays via an alpha-emitting daughter.

4. Hydroxyapatite according to claim 3 wherein the beta-emitting radionuclide is ^{212}Pb, ^{211}Pb, ^{213}Bi or ^{225}Ra.

5. Hydroxyapatite according to any one of claims 1 to 4 wherein the HA comprises a cation that is bivalent or trivalent or a mixture of such cations.

6. Hydroxyapatite according to claim 5 wherein the cation is chosen from the group consisting of calcium, strontium, barium, bismuth, yttrium, lanthanum, lead or mixtures thereof.

7. Hydroxyapatite according to any one of claims 1 to 6, wherein the HA is particulate and has a size in the range of 1 nm to 100 μm.

8. Hydroxyapatite according to claim 7 wherein the HA has a size in the range of 1 μm to 20 μm.

9. Hydroxyapatite according to any one of claims 1 to 8, wherein the HA is surface modified with amino acids, peptides, proteins, antibodies, carbohydrates,

phosphonates, fluorine, magnetic substances, folate groups or a combination thereof.

10. Hydroxyapatite according to any one of claims 1 to 9, wherein the HA is combined or co-sedimented with a substance selected from the following group: metals, oxides, proteins, amino acids, carbohydrates, phosphonates including bisphosphonates or organic compounds.

11. Hydroxyapatite according to any one of claims 1 to 9, wherein the HA is combined or co-sedimented with a substance selected from polylactide, polyethyleneketones, glass-ceramics, titania, alumina, zirconia, silica, polyethylene, epoxy, polyethyleneglycol, polyhydroxybutyrate, gelatin, collagen, chitosan, phosphazene, iron, iron oxides, magnetic iron or mixtures thereof.

12. A process for preparing a radionuclide-labeled hydroxyapatite particulate, said process comprising:

(a) contacting a solution of an alpha-emitting radionuclide or an *in vivo* generator of an alpha-emitting radionuclide with hydroxyapatite particulates; and

(b) optionally crystallizing a coating of hydroxyapatite on the labeled particulates prepared in step (a) whereby to encapsulate said radionuclide or said *in* vivo generator in the particulate.

13. A process as claimed in claim 12 wherein step (a) is carried out at a pH in the range 3-12.

14 A process as claimed in claim 12 or claim 13 wherein said *in vivo* generator of an alpha-emitting radionuclide is ^{212}Pb and, prior to steps a) and b), said method additionally comprises;

i) Preparing ^{224}Ra,
ii) Purifying the ^{224}Ra by contact with an f-block specific binder ,
iii) Allowing ingrowth of ^{212}Pb, and
iv) Purifying the resulting ^{212}Pb by contact with a lead-specific binder

15. A pharmaceutical composition comprising a hydroxyapatite as claimed in any one of claims 1 to 11 and a physiologically acceptable carrier.

16. A pharmaceutical composition according to claim 15 in liquid, injectable form.

17. A pharmaceutical composition according to claim 15 in gel form.

18. Use of hydroxyapatite (HA) and an alpha-emitting radionuclide or a radionuclide which is an *in vivo* generator for an alpha-emitting radionuclide in the manufacture of a medicament for use in the treatment of a cancerous or non-cancerous disease.

19. Use as claimed in claim 18 wherein said medicament is an injectable, infusable or locally applicable medicament.

20. Use as claimed in claim 18 or claim 19 wherein said treatment comprises radiosynovectomy.

21. Use as claimed in claim 18 or claim 19 wherein said treatment comprises intratumor therapy.

22. Use as claimed in claim 18 or claim 19 wherein said treatment comprises administration into the blood supply of a cancerous organ.

23. A device comprising hydroxyapatite incorporating an alpha-emitting radionuclide or an *in vivo* generator for an alpha-emitting radionuclide.

24. A method of radiochemical treatment of a human or non-human animal subject in need thereof, said method comprising administering to said subject an effective amount of a hydroxyapatite as claimed in any one of claims 1 to 11 or of a composition as claimed in any one of claims 15 to 17.

25. A method as claimed in claim 24 for the treatment of an intracavitary primary or metastatic tumor.

26. A method as claimed in claim 24 for radiosynovectomy.

27. A method as claimed in claim 24 for intratumor therapy.

28. A method as claimed in claim 24 for anticancer therapy.

29. A method as claimed in claim 24 for anticancer treatment and/or sterilization of tumor bed and optionally the cavity in the case of an intracavitary tumor, wherein said administration is effected after surgical removal of at least part of a tumor.